

What is claimed is:

1. A sensor for rapid optical distance measurement based on a confocal imaging principle, comprising:
 - a light source, adapted to emit an illuminating light with different spectral components;
 - an optical imaging system, adapted to direct the illuminating light onto a surface of a measurement object, wherein different spectral components of the illuminating light are adapted to be focused at different distances from the optical imaging system due to a chromatic aberration of the optical imaging system;
 - a beam splitter, arranged so that the measuring light, reflected back at least partially from the surface, is adapted to be separated spatially from the beam path of the illuminating light;
 - a light receiver, adapted to detect the measuring light separated spatially from the beam path of the illuminating light with spectral resolution; and
 - an analysis unit, adapted to determine the distance between the sensor and the surface from the intensities of the measuring light detected for different spectral components.
2. A sensor according to claim 1, wherein the measuring light is also fed through the optical imaging system.
3. A sensor according to claim 1, wherein the light source is a white light source.
4. A sensor according to claim 1, wherein the light receiver is a color camera.
5. A sensor according to claim 1, wherein the light source includes a plurality of point light sources and the light receiver includes a plurality of point detectors, wherein one point detector and one point light source are associated together and are arranged in a confocal manner in relation to each other.

6. A sensor according to claim 5, wherein a grating system with a plurality of diffraction gratings is used to provide at least one of the point light sources and the point detectors.
7. A sensor according to claim 6, wherein the grating system is at least one of a one-dimensional diffraction grating line and a two-dimensional diffraction grating matrix.
8. A sensor according to claim 6, wherein the grating system also has an arrangement of microlenses.
9. A sensor according to claim 1, further comprising:
at least one further optical imaging system, arranged such that in the beam path of the illuminating light, an intermediate image of the light source is adapted to result, in an area between the further optical imaging system and the optical imaging system.
10. A sensor according to claim 9, wherein a grating system, including at least one diffraction grating, is arranged in the area of the intermediate image.
11. A sensor according to claim 10, wherein the grating system includes a rotating Nipkow disk and wherein the light receiver includes a surface detector.
12. A sensor according to claim 10, wherein the grating system includes a stationary at least one of a one-dimensional and two-dimensional diffraction grating matrix and wherein the light receiver includes at least one of a one-dimensional and two-dimensional local resolution surface detector.
13. A sensor according to claim 2, wherein the light source is a white light source.
14. A sensor according to claim 13, wherein the light receiver is a color camera.

15. A sensor according to claim 14, wherein the light source includes a plurality of point light sources and the light receiver includes a plurality of point detectors, wherein one point detector and one point light source are associated together and are arranged in a confocal manner in relation to each other.

16. A sensor according to claim 7, wherein the grating system also has an arrangement of microlenses.

Abstract

17. A sensor according to claim 15, wherein a grating system with a plurality of diffraction gratings is used to provide at least one of the point light sources and the point detectors.

18. A sensor according to claim 17, wherein the grating system is at least one of a one-dimensional diffraction grating line and a two-dimensional diffraction grating matrix.

19. A sensor according to claim 17, wherein the grating system also has an arrangement of microlenses.

20. A sensor for optical distance determination based on a confocal imaging principle, comprising:

optical imaging means for directing illuminated light onto a surface of a measurement object, and for focusing different spectral components of the illuminated light at different distances from the optical imaging means due to a chromatic aberration of the optical imaging means;

means for spatially separating measuring light, reflected back at least partially from the surface, from a beam path of the illuminated light; and

means for determining the distance between the sensor and the surface from intensities of the measuring light detected for different spectral components.

21. A sensor according to claim 20, wherein the measuring light is also fed through the optical imaging system.

- 22. A sensor according to claim 20, further comprising means for generating the illuminated light.
- 23. A sensor according to claim 22, wherein the means for generating includes a white light source.
- 24. A sensor according to claim 20, further comprising:
means for detecting the light for different spectral components.
- 25. A sensor according to claim 24, wherein the means for detecting includes a color camera.
- 26. A sensor according to claim 22, further comprising:
means for detecting the light for different spectral components.
- 27. A sensor according to claim 26, wherein the means for generating the illuminated light includes a plurality of point light sources and the means for detecting the light includes a plurality of point detectors, wherein one point detector and one point light source are associated together and are arranged in a confocal manner in relation to each other.
- 28. A sensor according to claim 27, wherein a grating system with a plurality of diffraction gratings is used to provide at least one of the point light sources and the point detectors.
- 29. A sensor according to claim 28, wherein the grating system is at least one of a one-dimensional diffraction grating line and a two-dimensional diffraction grating matrix.
- 30. A sensor according to claim 28, wherein the grating system also has an arrangement of microlenses.

31. A sensor according to claim 20, further comprising:
at least one further optical imaging means, arranged for, in the beam path of the illuminating light, producing an intermediate image of the light, in an area between the further optical imaging means and the optical imaging means.
32. A sensor according to claim 31, wherein a grating system, including at least one diffraction grating, is arranged in the area of the intermediate image.
33. A sensor according to claim 32, wherein the grating system includes a rotating Nipkow disk and further comprising means for detecting the light, including a surface detector.
34. A sensor according to claim 32, wherein the grating system includes a stationary at least one of a one-dimensional and two-dimensional diffraction grating matrix and further comprising means for detecting the light, including at least one of a one-dimensional and two-dimensional local resolution surface detector.
35. A method of optical distance determination based on a confocal imaging principle, comprising:
directing illuminated light onto a surface of a measurement object;
focusing, using an optical imaging device of a sensor, different spectral components of the illuminated light at different distances from the optical imaging device due to a chromatic aberration of the optical imaging device;
spatially separating measuring light, reflected back at least partially from the surface, from a beam path of the illuminated light; and
determining a distance between the sensor and the surface from intensities of the measuring light detected for different spectral components.
36. A sensor for rapid optical distance determination based on a confocal imaging principle, comprising:
a light source, adapted to emit an illuminating light with different spectral components;

an optical imaging system, adapted to direct the illuminating light onto a surface of a measurement object, wherein different spectral components of the illuminating light are adapted to be focused at different distances from the optical imaging system due to a chromatic aberration of the optical imaging system;

a beam splitter, arranged so that the measuring light, reflected back at least partially from the surface, is adapted to be separated spatially from the beam path of the illuminating light; and

an analysis unit, adapted to determine the distance between the sensor and the surface from the intensities of the measuring light detected for different spectral components.